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UNITED NATIONS (UN) PERFORMANCE ORIENTED PACKAGING (POP) TESTING OF DS2 CONTAINERS

Prepared for:
U.S. Army Armament Research,
Development and Engineering Center
ATTN: SMCAR-ESK
Rock Island, IL 61299-7300

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SAVANNA, ILLINOIS 61074-9639

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The U.S. Army Defense Ammunition Center and School (USADACS), Validation Engineering Division (SMCAC-DEV), was tasked by U.S. Army Armament Research, Development and Engineering Center (ARDEC), SMCAR-ESK, to perform Performance Oriented Packaging (POP) testing on DS2, level II, containers to determine their suitability for the transportation and storage of chemical decontaminating agents. At ARDEC, SMCAR-ESK, requested POP testing was conducted at the level I requirements with all containers passing this more severe testing. The following report contains details of the tests conducted.

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VALIDATION ENGINEERING DIVISION
SAVANNA, IL 61074-9639

REPORT NO. 92-08

UNITED NATIONS (UN) PERFORMANCE ORIENTED PACKAGING (POP) TESTING OF DS2 CONTAINERS

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PART 1

INTRODUCTION

A. BACKGROUND. The U.S. Army Defense Ammunition Center and School (USADACS), Validation Engineering Division (SMCAC-DEV), was tasked by U.S. Army Armament Research, Development and Engineering Center (ARDEC), SMCAR-ESK, to conduct Performance Oriented Packaging (POP) testing on DS2, Level II, containers to determine their suitability for the transportation and storage of chemical decontaminating agents. At ARDEC, SMCAR-ESK, requested POP testing was conducted at the more severe level I requirements. These tests were conducted due to changes in the container's wall thickness and improper sealing of the container's closure during tests conducted by another agency.

B. AUTHORITY. This program was conducted IAW mission responsibilities delegated by the U.S. Army Armament, Munitions and Chemical Command (AMCCOM), Rock Island, IL.

C. OBJECTIVE. To verify that DS2 steel containers meet United Nations (UN) POP, level I, test requirements for the transportation and storage of hazardous chemical decontaminating agents.

D. CONCLUSION. The DS2 containers submitted for UN POP testing were required to pass level II packaging requirements. All containers were tested to level I requirements, although more severe, no problems were encountered during testing. All containers either met or exceeded UN POP, Level I, requirements.

PART 2

ATTENDEES

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PART 3

TEST PROCEDURES

Test procedures outlined in this section were summarized from the Federal Register, Volume 55, Rules and Regulations, section 178.601 - 178.608. This publication identifies steps that a package must undergo to be considered acceptable for POP requirements.

A. Stacking Test. Three test samples were subjected to a force applied to the top surface of the test sample equivalent to the total weight of a stacked load during transport. The minimum height of the stack, including the test sample, must be 3.0 meters (10 feet). Plastic containers, jerricans, and composite packaging intended for liquids must be subjected to the stacking test for a period of 28 days at a temperature of not less than 40 degrees Centigrade (104 degrees Fahrenheit).

B. Vibration Test. Three test samples were selected at random, filled with inert material, and closed per POP shipping requirements prior to testing. The samples were placed on a vibrating platform that has a vertical double-amplitude (peak-to-peak displacement) of one inch. The packages were constrained horizontally to prevent them from falling off the platform; however, the packages were left free to move vertically, bounce, and rotate. This test was performed for 1 hour at a frequency that caused the package to be raised from the vibrating platform to a point where a 0.063-inch-thick feeler gage could pass between the test sample and platform.

C. Leakproofness Test. Three samples were restrained under water while an internal air pressure was applied. The method of restraint did not affect the results of the test. The test was conducted for a period of time sufficient to verify the package does not leak. Pressures required on the interior of the samples must be 4 psi for packing group I and 3 psi for packing groups II

and III. As an alternate test to this procedure, the container may be filled with helium to the proper pressure and checked with a mass spectrometer for leakproofness.

D. Hydrostatic Test. Three test samples were required for each type of container. All vented closures were either replaced with nonvented closures or the vent was sealed. All packages that were not made of plastic were subjected to a test pressure for 5 minutes with plastic packaging being subjected to a test pressure for 30 minutes. The test pressure must be applied continuously and evenly and kept constant throughout the test period. Level I packages were tested to a minimum pressure of 36 psi while levels II and III packages tested to a minimum pressure of 15 psi. The packages pass the hydrostatic test if there is no leakage of liquid from the package.

E. Drop Test. The test samples must be filled to 96 percent of their capacity for solids and 98 percent of their capacity for liquids, with the inert material being of equal or higher specific gravity than what normally filled the package. Paper and fiberboard containers must be preconditioned for a period of 24 hours before testing. Plastic containers must be preconditioned to -18.0 degrees Centigrade (0 degrees Fahrenheit) before testing. The drop height for packaging group I is 5.9 feet, packaging group II is 3.9 feet, and packaging group III is 3 feet. For containers containing specific gravity exceeding 1.2 the drop height for packaging group I must be 4.9 feet, packaging group II 3 feet, and packaging group III 2.2 feet. The number of containers dropped and the drop orientation are as follows:

Type	Number	Orientation
Drums	3	Containers must strike the target diagonally on the chime or circumferential seam or edge.
	3	Containers must strike the target on the weakest point not tested by the first drop such as closure, seam on drum body, etc.
Boxes	1	Flat to the bottom.
	1	Flat to the top.
	1	Flat on the long side.
	1	Flat on the short side.
	1	On the corner of the container.

PART 4

ITEM TESTED

DS2 5-GALLON CONTAINERS
(Test Samples)

1. Diameter:	11 inches
2. Height:	13 1/2 inches
3. Capacity:	Five gallons
4. Gage:	22
5. Department of Transportation (DOT) Specification:	17C

PART 5

TEST RESULTS

A. STACKING TEST. The stacking test was conducted on three samples. Each sample was vertically loaded to approximately 1,070 pounds, simulating a 16-foot-high stack. This test was conducted for a period of 24 hours, with no damage noted during testing.

B. VIBRATION TEST. The vibration test was conducted on three samples. Each sample was vibrated at approximately 250 revolutions per minute (rpm) for a period of 1 hour. The test was initially performed on two samples without the inner lids being soldered. These samples were vibrated, one on its base and the other upside down, with no leakage occurring. The third sample had the inner seal soldered and was vibrated on its side with no leaks occurring.

C. LEAKPROOFNESS TEST. Three samples were pressurized to 4 psi with helium, and using the mass spectrometer, leak inspection methodology tested to 1 X 10-7 cc/he/sec, with no leaks detected. The samples were then tested using water submersion leak detection methodology, again, no leaks were detected.

D. HYDROSTATIC TEST. Three samples were pressurized to 36 psi for a period of five minutes with no leaks occurring (see graphs nos. 1 - 3). After testing, severe deformation and bulging of the containers were noted during removal from the test chamber (see enclosed photos).

E. DROP TEST. Three samples were dropped a total of 6 times from 5.9 feet. The first three drops were to the top chime and closure at a 45 degree angle. No leaks occurred during the first series of tests. The next three drops, using the same containers, were flat to the container side seams, again, no leaks occurred. After testing, severe container deformation was noted (see enclosed photos).

PART 6

PHOTOGRAPHS

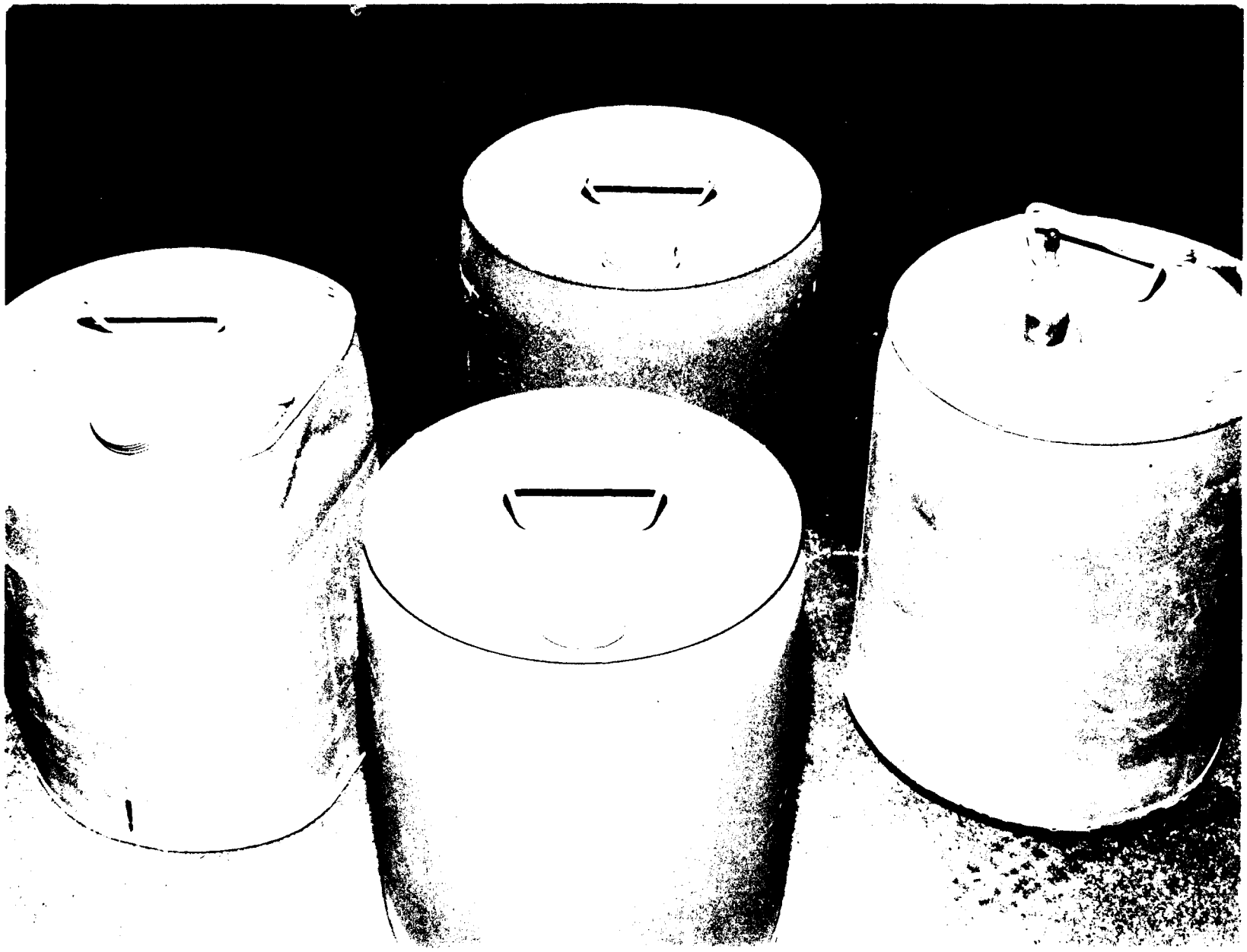

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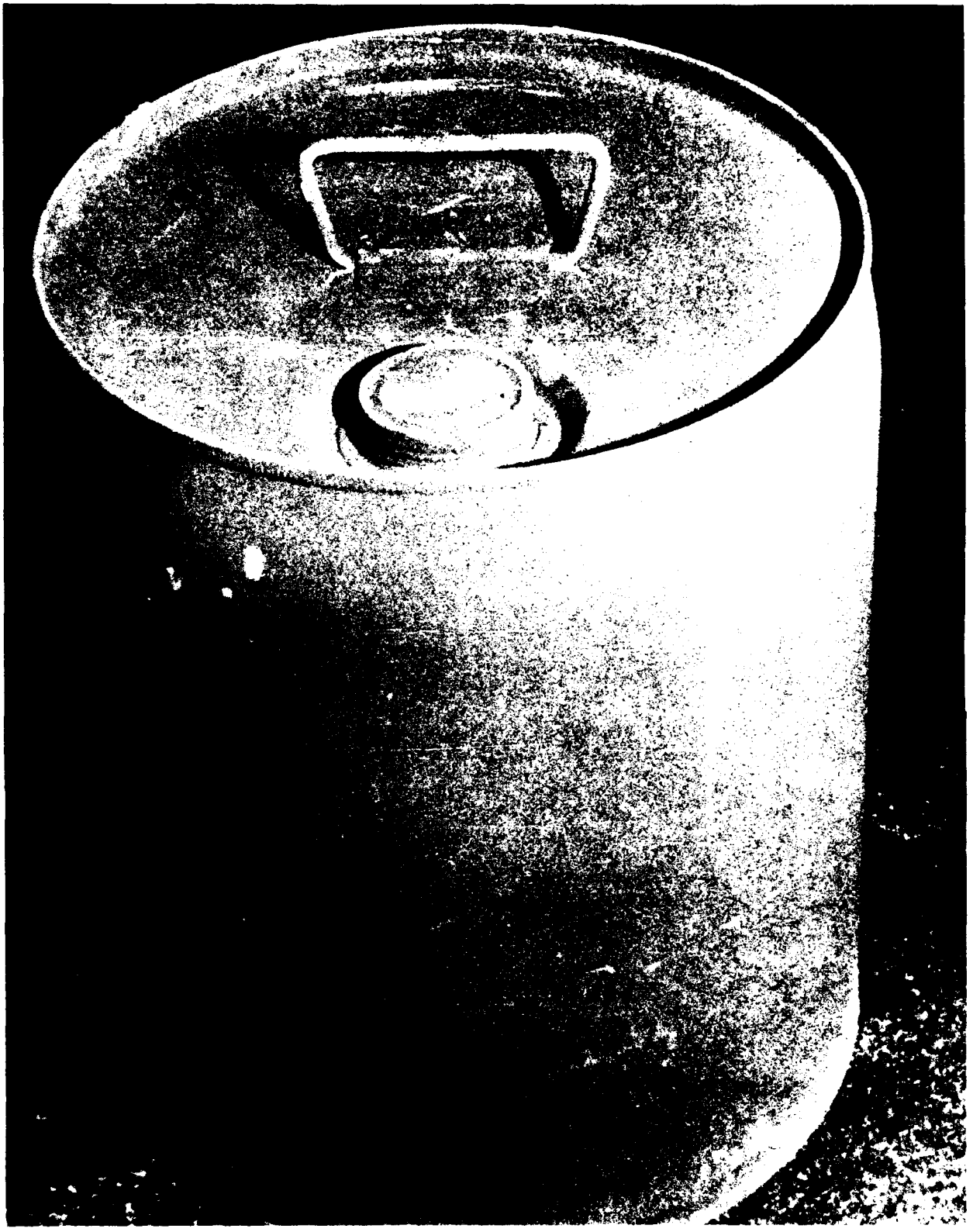
Photo No. AO317-SPN-92-134-1129. This photo shows an overall view of DS2 containers. Note, sample on the right was hydrostatically tested while the container on the left was drop tested.



	U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL - SAVANNA, IL	
Photo No. AO317-SPN-92-134-1131. This photo shows a closeup view of the DS2 container prior to testing.		

	U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL - SAVANNA, IL	

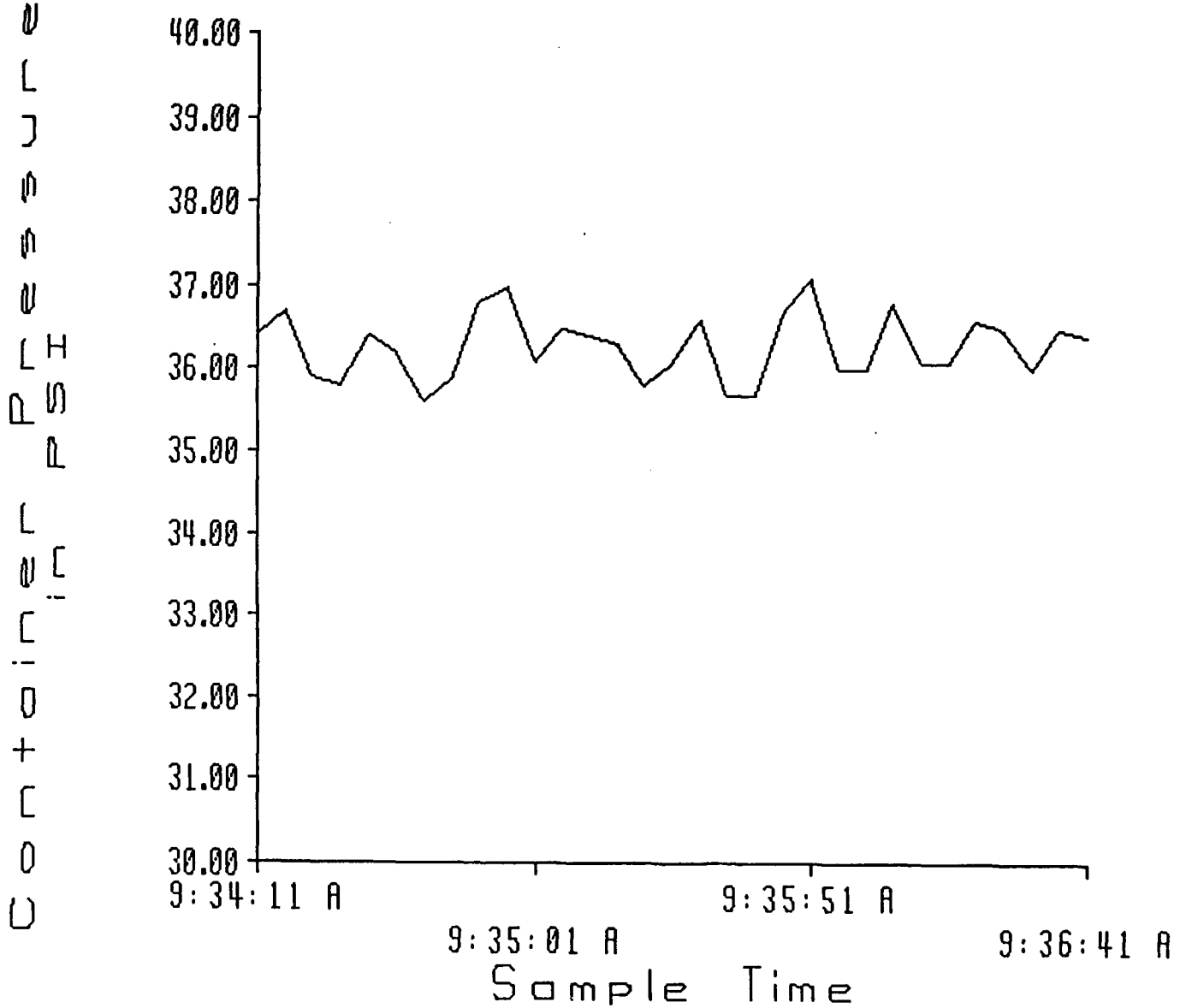
Photo No. AO317-SPN-92-134-1133. This photo shows a closeup view of the DS2 container after the low-frequency vibration test and the 5.9-foot drop test. Note, this container went through two drops, one to the side and one 45 degrees to the chime enclosure opening, without leaking.

PART 7

GRAPHS

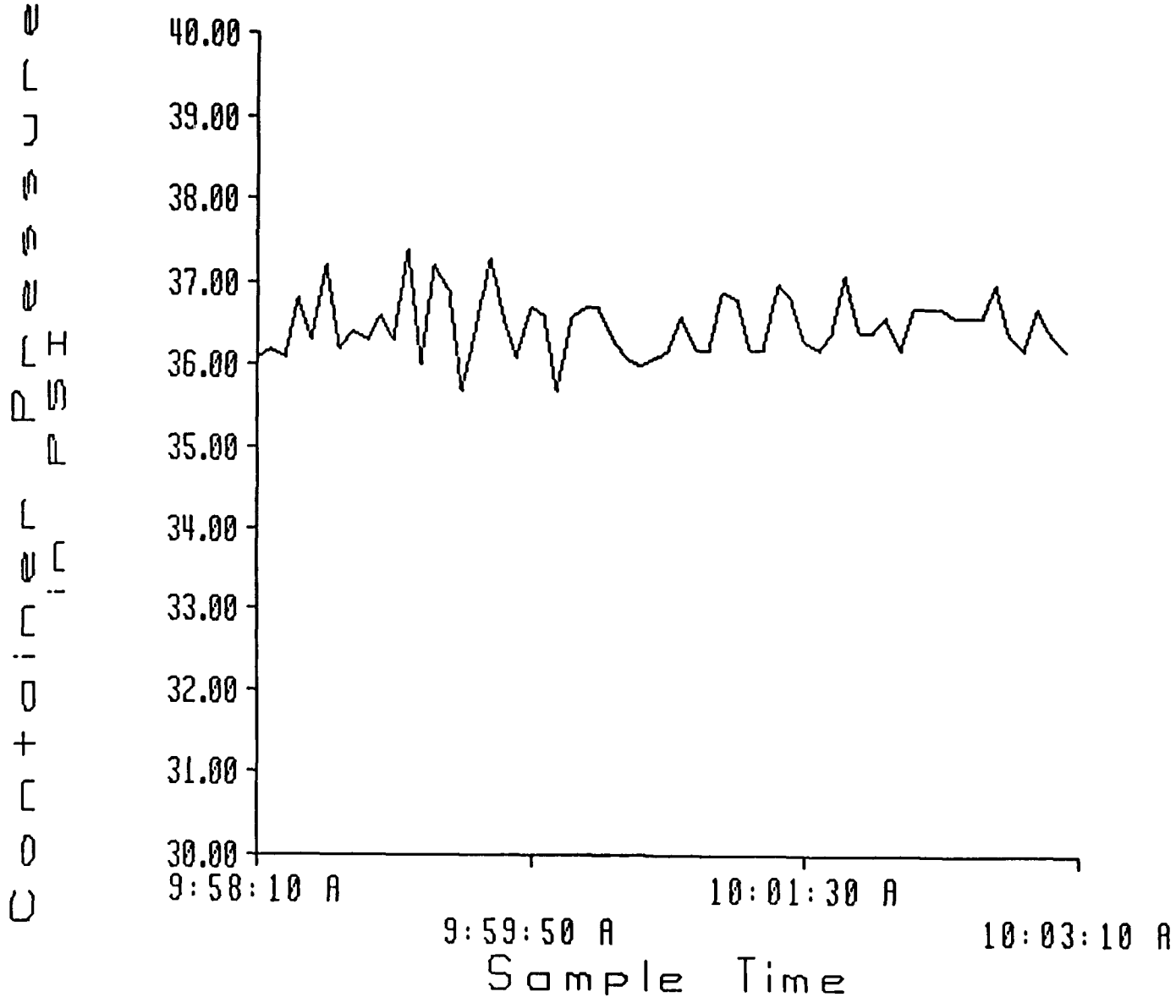
Hydrostatic Test 1

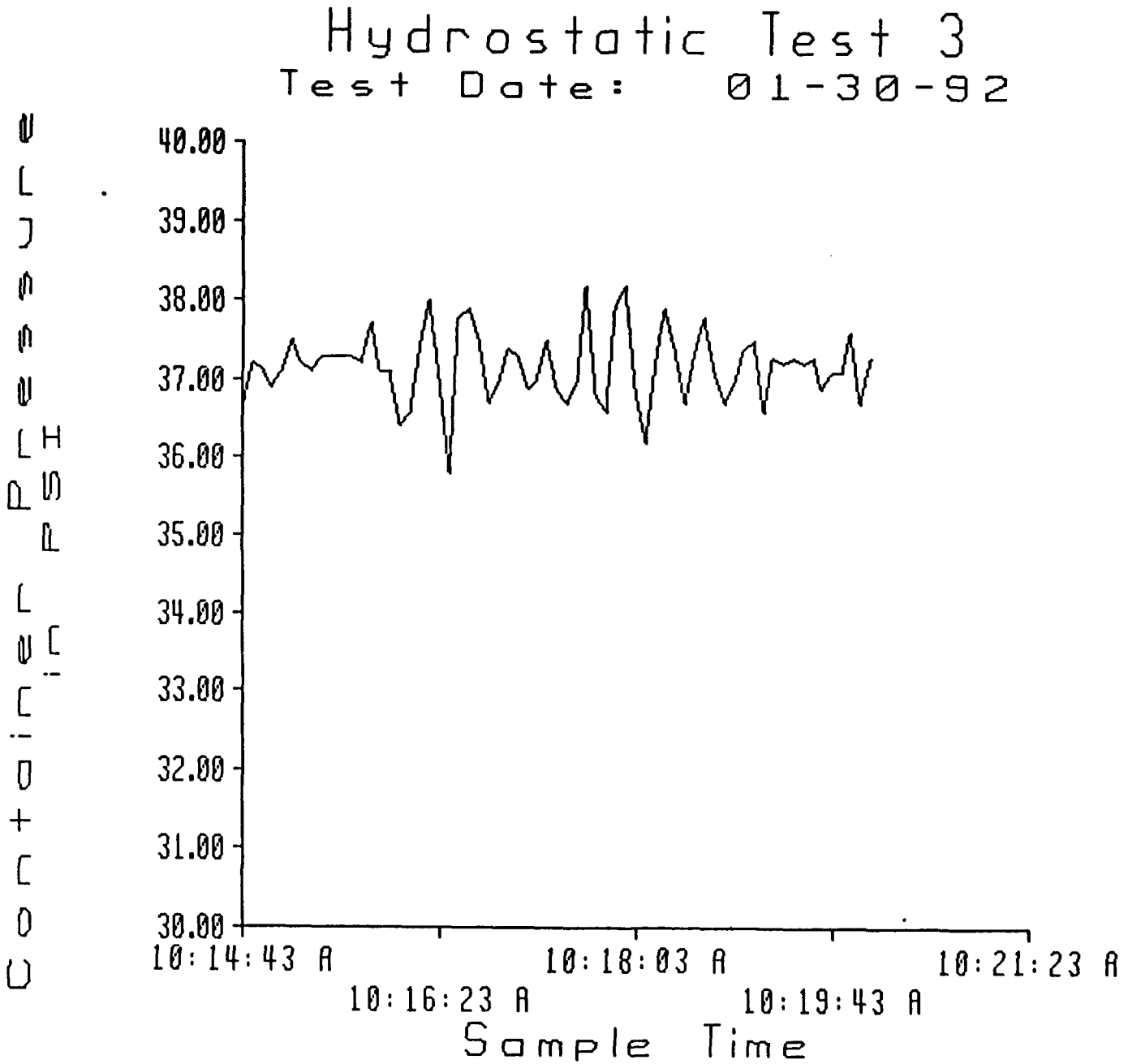
Test Date: 01-30-92



Hydrostatic Test 2

Test Date: 01-30-92




Hydrostatic Test 3
Test Date: 01-30-92
Pressure (PSIG)
40.00
39.00
38.00
37.00
36.00
35.00
34.00
33.00
32.00
31.00
30.00
10:14:43 A
10:16:23 A
10:18:03 A
10:19:43 A
10:21:23 A
Sample Time